

Cleanup Action Report

Soil Remedial Excavation

Thomas Oil Site/Northwest Maritime Center

431 Water Street

Port Townsend, Washington

VCP Number SW0384

August 12, 2002

For

City of Port Townsend

**CLEANUP ACTION REPORT
SOIL REMEDIAL EXCAVATION
THOMAS OIL SITE/NORTHWEST MARITIME CENTER
431 WATER STREET
PORT TOWNSEND, WASHINGTON
VCP NUMBER SW0384
FOR
CITY OF PORT TOWNSEND**

INTRODUCTION AND BACKGROUND

This report documents the results of soil remedial excavation activities completed during June and July 2002 at the Thomas Oil Site/Northwest Maritime Center located at 431 Water Street in Port Townsend, Washington (referred herein as the "site"). The reader is referred to the previous reports listed below for the site use and ownership history. The site location is shown in relation to surrounding physical features on Figure 1. The site layout, property line, former facilities and surrounding properties are shown in Figure 2.

The site topography is relatively flat with a slight downward slope toward Admiralty Inlet/Port Townsend Bay, southeast of the site. Ground surface conditions outside the building areas consisted mainly of gravel and concrete at the time the remedial excavation was conducted. The site is fenced. Point Hudson Marina and vacated Jackson Street are located northeast of the site, commercial buildings are situated across Water Street to the northwest, a vacant gravel lot and city park are situated to the southwest and Port Townsend Bay/Admiralty Inlet is located southeast of the site.

Previous environmental reports for the site are as follows:

1. April 1989 report for Pacific Oil Products by AGI Technologies.
2. September 1989 report for Pacific Oil Products by AGI Technologies.
3. "Site Assessment Summary, Former Texaco and Unocal Bulk Facilities, 431 Water Street, Port Townsend, Washington," dated May 25, 1995 for Pacific Oil Products by AGI Technologies.
4. "Remedial Investigation/Feasibility Study (RI/FS), Thomas Oil Site, Port Townsend, Washington," dated May 5, 2000 for The Port of Port Townsend and Northwest Maritime Center by HartCrowser.
5. "Cleanup Action Plan (CAP), Thomas Oil Site, Port Townsend, Washington," dated May 17, 2000 for The Port of Port Townsend and Northwest Maritime Center by HartCrowser.

The RI/FS documents soil and groundwater conditions at the site based on past sampling conducted. The Cleanup Action Plan (CAP) documents the remedy selection and applicable cleanup standards and cleanup action levels for the site. The preferred cleanup remedy as detailed in the CAP is to remove accessible soil with concentrations of petroleum greater than the TPH action level of 6,500 milligrams per kilogram (mg/kg) and to remove a localized area of metals-impacted sand blast grit. These areas are referred to as "hot spots." The cleanup remedy also includes capping with a clean (noncontaminated) soil cover to prevent direct contact exposures and natural attenuation with engineering and institutional controls.

PURPOSE AND SCOPE

The purpose of the 2002 remedial excavation was to remove accessible "hot spot" contaminated soil as documented in the RI/FS and CAP. GeoEngineers' specific scope of services completed for this phase of activities is listed below:

1. Participated in a pre-construction site meeting with representatives to discuss project logistics and schedule.
2. Developed a public notice that describes cleanup activities.
3. Notified Ecology's Toxics Cleanup Program at least one week prior to beginning site work.
4. Obtained pre-approval for receipt of petroleum-contaminated soil and metals-impacted soil from the site at Waste Management's Olympic View, Kitsap County, Washington landfill.
5. Obtained pre-approval from the City of Port Townsend for short-term discharge to the sanitary sewer of accumulated water removed during remedial excavation activities.
6. Prepared a written site safety plan for GeoEngineer's personnel during performance of the work.
7. Obtained characterization samples representative of metals-contaminated soil to be removed for off-site disposal. Submitted the sample for analysis of pH by EPA Methods, total metals by EPA Method 6000/7000 series, and leachable metals by Toxicity Characteristic Leaching Procedure (TCLP) using EPA testing methodology.
8. Observed soil conditions and use soil field screening to advise the contractor regarding vertical and lateral limits of remedial excavation and segregation of apparent noncontaminated overburden. Soil field screening methods consisted of visual observation, water sheen and headspace vapor screening.
9. Obtained cleanup confirmation soil samples from the base and walls of the remedial excavations at the rate of approximately one sample per 400 square feet of excavation surface area.
10. Field screened samples and submitted the cleanup confirmation soil samples to North Creek Analytical laboratory for chemical analyses of one or more of the following: benzene, ethylbenzene, toluene and xylenes (BETX) by EPA Method 8021B, gasoline-range hydrocarbons by Ecology Method NWTPH-Gx, diesel- and heavy oil-range hydrocarbons by Ecology Method NWTPH-Dx, polynuclear aromatic hydrocarbons (PAHs) by EPA Method 8270 using GC/MS-SIM and total metals by EPA 6000/7000 series.
11. Obtained a characterization sample of water removed during the remedial excavation activities for testing in accordance with sanitary sewer discharge criteria. Submitted the water sample for analyses of total metals by EPA Method 6000/7000 series, fats, oils and grease (FOG) by EPA Method 1664, pH, total suspended solids and volatile suspended solids by APHA/EPA Methods.
12. Evaluated the field and laboratory data with respect to the site cleanup action levels and cleanup standards and prepared a summary report of the remedial excavation activities.

REMEDIAL EXCAVATION

GENERAL

Remedial excavation and capping were performed in June and July 2002. The City of Port Townsend selected Wyser Construction to perform the demolition and remediation activities at the site. GeoEngineers was selected by the City of Port Townsend as the project environmental

consultant to observe and document remedial excavation. Demolition and remediation activities were conducted in general accordance with the Project Manual Bid Documents prepared by the City of Port Townsend (Project B-01-DC-53-0001), including the "Work Plan, Demolition and Remediation Activities," dated April 9, 2002.

AUTHORIZATIONS AND PERMITS

The Washington State Department of Ecology concurred with the remedy selection and Work Plan as documented in their letters dated May 12, 2000 and March 29, 2002 to the Northwest Maritime Center. The site is entered in the Voluntary Cleanup Program (VCP).

Project permits were obtained by the Northwest Maritime Center and are on file at their offices in Port Townsend.

GeoEngineers obtained clearance from Waste Management's Olympic View landfill in Kitsap County, Washington for their acceptance of petroleum- and metals-contaminated soil to be excavated from the site. Based on previous soil sample data from the site, Waste Management provided authorization for acceptance of petroleum-contaminated soil excavated from the site. Supplemental authorization was received for the metals-impacted sand based on waste characterization sampling. Copies of the landfill profiles are included in Appendix A.

GeoEngineers obtained wastewater discharge approval from the City of Port Townsend for discharge of water removed during remedial excavation activities. Copies of the water discharge documentation are included in Appendix B.

CLEANUP STANDARDS AND ACTION LEVELS

The CAP references the following cleanup standards and action levels for soil at the site.

Constituent	Proposed Cleanup Level
Benzene	0.15 ¹
Ethylbenzene	280 ²
Toluene	1,400 ²
Xylenes	800 ²
Non-Carcinogenic TPH	3,400 ³
Middle Distillate Hydrocarbons	6,500 ⁴
CPAHs (carcinogenic polynuclear aromatic hydrocarbons)	1 ⁵
Arsenic	20 ⁵
Cadmium	1 ⁵
Copper	2,960 ¹
Lead	250 ⁵
Zinc	24,000 ¹

1. Based on MTCA Method B direct contact cleanup level.
2. Based on MTCA Method B surface water protection. Proposed cleanup levels were calculated using the three phase approach. A site average TOC level of 1 percent was used.
3. Based on MTCA Method B direct contact cleanup level using Interim TPH Policy.
4. Based on API residual saturation literature value for middle distillates in a medium to coarse sand.
5. Based on proposed MTCA Method A residential cleanup levels (Ecology, 1999).

The middle distillate hydrocarbons residual saturation value of 6,500 mg/kg was used as the cleanup action level for petroleum (TPH as the sum of gasoline-, diesel- and heavy oil-range hydrocarbons) in soil.

DEMOLITION

Wyser Construction performed building demolition in advance of excavation activities in accordance with the City's project manual bid documents. GeoEngineers did not observe demolition activities.

REMEDIAL EXCAVATION APPROACH

Soil remedial excavation activities were performed by Wyser Construction of Everett, Washington between June 24 and July 3, 2002. GeoEngineers' representative was present on site daily during soil excavation activities. Three hot spot excavation areas are identified in the CAP: (1) the vicinity of the former Unocal tank farm (referred to as Excavation1, or Ex1 in this report); (2) metal-impacted soil at the corner of Ex1; and (3) an area north of the warehouse, referred to as Excavation 2, or Ex2, in this report). A third small hot spot soil excavation, referred to as Ex3, also was performed near the northeast side of the former Texaco tank area. Ex3 was performed because during demolition activities, a fuel pipe was observed leaking into the subsurface at the Ex3 location. Soil sample identifications used during remedial excavation were based on the sample location (e.g., Ex1), the consecutive sample number (e.g., Ex-1-1) followed by the sample depth in feet bgs (e.g., Ex1-1-1.0).

The metals-impacted soil was removed initially from Ex1 and cleanup confirmation samples were obtained. The area of metals-impacted sand was located in the north corner of Ex1 from approximately 1 foot to 4 feet bgs.

Removal of petroleum-impacted soil at Ex1 and Ex2 was initially performed to the depths and size indicated in the CAP. Segregation of overburden soil (to be reused on site as backfill) from impacted soil (to be transported off site for disposal) was based on the depths and locations indicated in the CAP. Cleanup confirmation soil samples were then obtained from the excavation limits for chemical analyses. If the concentration of TPH (as the sum of gasoline-, diesel- and heavy oil-range hydrocarbons) was greater than the action level of 6,500 mg/kg in any sample, then additional excavation was conducted and the area was resampled. Overexcavation also was performed if the concentration of CPAHs in cleanup confirmation soil samples was greater than the cleanup level of 1 mg/kg. In most cases, overexcavation also was performed if the concentration of benzene in cleanup confirmation soil samples was greater than the cleanup level of 0.15 mg/kg.

Soil field screening using visual, headspace vapors and water sheen screening were conducted on cleanup confirmation samples for comparison purposes; however, field screening could not be used to distinguish soil that was above or below the TPH action level and field screening was not used to segregate overburden from impacted soil. Overburden soil was sampled before reuse to confirm that contaminant concentrations were less than the action levels (see report section titled Overburden Soil).

The approximate location of the excavations and soil samples from the excavations are shown in Figure 3. Soil sample chemical analytical data are summarized in Tables 1 and 2. Field procedures are described in Appendix C. Chemical analytical data sheets and our review of the laboratory quality control (QC) data are provided in Appendix E.

Ex1, Ex2 and Ex3 were excavated to maximum depths of 12 feet, 10 feet and 2 feet bgs, respectively. Excavation activities were conducted when tides were generally at their lowest. Groundwater was encountered in Ex1 and Ex2 at approximately 8 feet bgs during excavation activities. Groundwater was not observed in Ex3 at the time of excavation. Accumulation of groundwater in the 2002 excavations was generated during high tides. Groundwater seeped into the excavations at 11 feet and 9 feet bgs in Ex1 and Ex2, respectively.

Subsurface soil conditions at the excavation locations consisted of silty sand fill from ground surface to approximately one foot below ground surface (bgs). Soil underlying the silty sand fill generally consisted of silty sand with gravel, shell fragments and occasional cobbles to approximately 11 feet bgs (Ex1 and Ex2). Subsurface soil at the Ex3 location consisted of silty sand.

CLEANUP CONFIRMATION SOIL SAMPLES

Metals Impacted Soil

Metals-impacted sand blast grit was located in the north corner of Ex1 from approximately 1 to 4 feet bgs. Soil representative of the metals-contaminated sand blast grit (Blast Grit-1) to be removed from Ex1 was obtained and submitted for chemical analysis of pH, total metals and TCLP metals for waste profiling purposes.

The metals-impacted soil was visually obvious and was removed and drummed. Following removal of the first 1-foot layer of metals-impacted sand, soil sample Ex1-1-1.0 was obtained. Metals concentrations in this sample (Table 1) were greater than the cleanup levels and so additional excavation was performed at this area. The final cleanup confirmation sample from the metals-impacted soil area was sample Ex1-31-4.0. Concentrations of metals in the final cleanup confirmation sample were less than the applicable cleanup levels.

A total of 1.49 tons (approximately one cubic yard) of metals-contaminated sand blast grit was transported off site to Waste Management's Olympic View landfill in Kitsap County, Washington.

Excavation 1, Former Unocal Tank Area

The final maximum depth of Ex1 was 12 feet bgs. A total of 54 samples were obtained from Ex1. Thirteen of these samples (Ex1-1 through Ex1-3, Ex1-13, Ex1-14, Ex1-16, Ex1-18, Ex1-19, Ex1-22, Ex1-23, Ex1-25, Ex1-28 and Ex1-33) were subsequently overexcavated (see Tables 1 and 2 and Figure 3 for full sample identification) because TPH and/or benzene concentrations in these samples were greater than the TPH action level of 6,500 mg/kg or the benzene cleanup level of 0.15 mg/kg. Approximately 450 tons (300 cubic yards) of clean overburden and 1,963 tons (1,309 cubic yards) of contaminated soil were removed from Ex1. The final excavation limits were represented by 41 excavation base and sidewall cleanup confirmation soil samples (Tables 1 and 2 and Figure 3).

Concentrations of TPH were less than the action level of 6,500 mg/kg in all 41 of the final cleanup confirmation samples. Concentrations of BETX and CPAHs were less than the cleanup standards in all 41 of the final cleanup confirmation samples except for three sidewall soil samples in which benzene concentrations were slightly greater than the cleanup standard of 0.15 mg/kg (Ex1-29-7.0, benzene = 0.193 mg/kg; Ex1-30-7.0, benzene = 0.182 mg/kg and Ex1-32-7.0, benzene = 0.165 mg/kg). Cleanup compliance with benzene was evaluated following MTCA statistical guidance as indicated in the report section below titled MTCA Statistical Evaluation.

Excavation 2, Former Fuel USTs

The final maximum depth of Ex2 was 10 feet bgs. A total of 15 soil samples were obtained from Ex2. One of these samples (Ex2-3-5.0) was subsequently overexcavated (see Tables 1 and 2 and Figure 3) because the benzene concentration in this sample was greater than the cleanup level. Approximately 90 tons (60 cubic yards) of clean overburden and 480 tons (320 cubic yards) of contaminated soil were removed from Ex2. The final excavation limits were represented by 14 excavation base and sidewall cleanup confirmation soil samples (Tables 1 and 2 and Figure 3). Concentrations of TPH were less than the action level of 6,500 mg/kg in all 14 of the final cleanup confirmation samples. Concentrations of BETX and CPAHs were less than the cleanup standards in all 14 of the final cleanup confirmation samples.

Excavation 3, Texaco Tank Area

Soil in the area of Ex3 was removed because of a small (less than 1 gallon) release discovered from an underground pipe observed at this location during demolition activities at the site. This small excavation was completed to a maximum depth of 2 feet bgs. A total of 4 samples were obtained from Ex3. One of these samples (SS-1) was subsequently overexcavated (see Tables 1 and 2 and Figure 3) because the concentration of CPAHs was greater than the cleanup standard of 1 mg/kg. No clean overburden and approximately 1.5 tons (1 cubic yard) of contaminated soil were removed from Ex3. The final excavation limits were represented by 3 excavation base and sidewall cleanup confirmation soil samples (Tables 1 and 2 and Figure 3). The detected concentrations of CPAHs were less than the cleanup standard of 1 mg/kg in the three final base and sidewall cleanup confirmation soil samples.

MTCA Statistical Evaluation

Cleanup confirmation compliance with the benzene cleanup standard was evaluated in accordance with the statistical evaluation procedures described in Ecology's publication "Statistical Guidance for Ecology Site Managers (Publication 92-54, August 1992)." Cleanup confirmation soil sample benzene data met the following three criteria as outlined in the document:

1. Less than 10 percent of the samples had benzene concentrations that exceeded the cleanup level.
 2. No single sample concentration of benzene was more than two times the cleanup level.
 3. The 95 percent upper confidence limit (UCL) of the data set was less than the cleanup level.
- This criterion was evaluated using Ecology's MTCASat software. MTCASat printouts are included in Appendix D. We evaluated the data assuming non-detects have a value of 1/2 the detection limit; this is a standard assumption per MTCA statistical guidance. We evaluated two data sets: the 38 final cleanup confirmation samples tested for benzene from Excavation 1 were evaluated as a data set and the 52 final cleanup confirmation samples tested for benzene from Excavations 1 and 2 were evaluated as a data set. Histograms for both data sets are attached in Appendix D. As is typical for environmental data sets of this type, neither the lognormal or normal sample distributions fit the data well. However, in the absence of any other way to calculate a 95 percent UCL for the data sets, MTCASat calculated the 95 percent UCL using the lognormal and normal distributions assumptions. In all cases, the 95 percent UCL was less than the cleanup level. Specifically, the 95 percent UCLs were 0.0414 and 0.0491 for lognormal and normal distributions, respectively, for the 38 sample data set and 0.0678 and 0.0701 for lognormal and normal distributions, respectively, for the 52 sample data set.

DISPOSITION OF PETROLEUM-CONTAMINATED SOIL

Waste Management accepted the petroleum-contaminated soil excavated from the site during the 2002 remedial activities, as discussed above. A total of 2,445 tons (about 1,630 in-place cubic yards) of petroleum-contaminated soil were removed from the excavations. Petroleum-contaminated soil either was temporarily stockpiled before loading or was loaded directly into trucks and transported to Waste Management's Olympic View landfill. The tipping receipts are included in Appendix A.

OVERBURDEN SOIL

Overburden was removed from Ex1 and Ex2 and segregated for stockpiling and testing prior to reuse. Approximately 540 tons (360 in-place cubic yards) of apparently noncontaminated soil overburden was stockpiled and was sampled as three populations: SP1, SP2 and ISP1 as summarized in Tables 3 and 4. Five discrete soil samples were obtained from SP1 (SP1-1 through SP1-5), three discrete soil samples from SP2 (SP2-1 through SP2-3) and three discrete soil samples from ISP1 (ISP1-1 through ISP1-3). The soil samples were submitted for chemical analysis of BETX, petroleum hydrocarbons and PAHs. BETX, petroleum hydrocarbons and PAHs either were not detected or were detected at concentrations less than the cleanup standards in the overburden stockpile samples. Soil stockpile sample chemical analytical data are summarized in Tables 3 and 4. Laboratory reports, chain of custody and quality control (QC) data are provided in Appendix C.

BACKFILLING AND CAPPING

Backfilling, compaction and capping were conducted by Wyser. GeoEngineers did not monitor backfilling, compaction and capping activities. We understand that approximately 5 feet of 2- to 4-inch quarry spalls were placed in base of the excavations and up to the groundwater seep zones. The clean overburden and approximately 3,883 tons of imported pit run material were used as backfill above the quarry spalls up to the ground surface. We understand that capping and final grading were performed as per the project manual bid documents.

WASTEWATER CHARACTERIZATION

GeoEngineers obtained one water sample (BT-1) from the onsite Baker Tank that stored water pumped from the 6,500-gallon oil/water separator that was removed during demolition. The water sample was obtained for waste discharge characterization testing per City of Port Townsend requirements prior to discharge into the sanitary sewer. Based on chemical analytical results, the specified analyte concentrations were within the limits of City of Port Townsend's disposal criteria. A copy of the City of Port Townsend's sanitary sewer discharge criteria is included in Appendix B. One 55-gallon drum of water from previous groundwater monitoring events conducted by others was disposed of into the petroleum-contaminated soil stockpile pending offsite disposal.

CONCLUSIONS

Soil remedial excavation was conducted in June and July 2002 to remove all "hot spot" areas of contaminated soil in accordance with the Cleanup Action Plan for the site. Following soil removal, the site was capped with at least 1 to 2 feet of imported, noncontaminated soil.

A total of approximately 1.5 tons of metals-impacted sand and 2,443 tons of petroleum-impacted soil were successfully removed from the site during the June and July 2002 remedial excavation activities. Based on analytical results from 55 cleanup confirmation soil samples obtained from the final limits of the three excavations completed, soil with petroleum concentrations greater than the TPH action level of 6,500 mg/kg was successfully removed from the site. Concentrations of metals, BETX and CPAHs were less than the cleanup standards in all final cleanup confirmation samples with the exception of three soil samples that contained benzene concentrations slightly greater than the cleanup level of 0.15 mg/kg. Based on statistical evaluation of the soil sample data using Ecology's statistical guidance, benzene data for the excavations are in compliance with the cleanup level for benzene.

LIMITATIONS

We have prepared this report for use by the City of Port Townsend and Northwest Maritime Center for remedial monitoring services completed at the Thomas Oil Site/Northwest Maritime Center. This report may be provided to Unocal and Ecology for review.

Within the limitations of scope, schedule and budget, our services have been executed in accordance with generally accepted environmental science practices in this area at the time this report was prepared. No warranty or other conditions, express or implied, should be understood.

Please refer to Appendix E titled "Report Limitations and Guidelines for Use" for additional information pertaining to use of this report.



We appreciate the opportunity to be of continued service to the City of Port Townsend and Northwest Maritime Center. Please contact us if you have questions regarding this project.

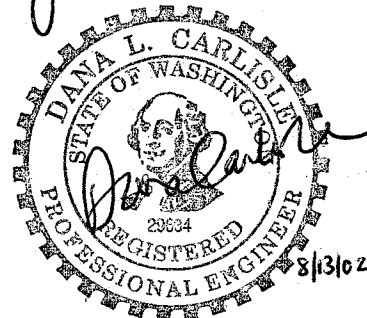
Respectfully submitted,

GeoEngineers, Inc. by

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TABLE 1 (PAGE 1 OF 4)
SUMMARY OF SOIL FIELD SCREENING AND BETX
CLEANUP CONFIRMATION SAMPLES
 THOMAS OIL SITE/NW MARITIME CENTER
 PORT TOWNSEND, WASHINGTON

Soil Sample Number - Depth Sampled ¹ (feet bgs)	Date Sampled	Sample Location	Field Screening Results ²		BETX ³ (mg/kg)						Gasoline-range Hydrocarbons ⁴ (mg/kg)	Diesel-range Hydrocarbons ⁵ (mg/kg)	Heavy Oil-range Hydrocarbons ⁵ (mg/kg)	Sum of TPH (mg/kg)	
			Headspace Vapors (ppm)	Sheen	B	BETX ³ (mg/kg)									
						E	T	X							
Excavation 1--Unocal Tank Farm															
Ex1-1-1.0 ⁶	06/24/02	Northeast Wall	<100	SS							Tested for Metals ⁷				
Ex1-2-6.0 ⁶	06/24/02	Southeast Wall	<100	HS	0.949	13.8	4.09	60.2	2,800 ⁸	4,250 ⁹	<500	7,050			
Ex1-3-7.0 ⁶	06/24/02	Southeast Wall	<100	HS	1.72	1.47	<0.500	6.21	1,540 ⁸	2,420	70.6	3,960			
Ex1-4-10.0	06/24/02	East Base	<100	MS	<0.0300	<0.0500	<0.0500	<0.100	<5.00	<10.0	<25.0	<6,500			
Ex1-5-10.0	06/24/02	Southeast Base	<100	MS	<0.0300	<0.0500	<0.0500	<0.100	<5.00	<10.0	<25.0	<6,500			
Ex1-6-11.0	06/24/02	Southeast Base	<100	MS	<0.0300	<0.0500	<0.0500	<0.100	7.05 ⁸	11.8	<25.0	18.9			
Ex1-7-10.0	06/24/02	South Base	<100	MS	<0.0300	<0.0500	<0.0500	<0.100	16.1 ⁸	23.2	<25.0	39.3			
Ex1-8-10.0	06/24/02	Northeast Base	<100	MS	<0.0300	<0.0500	<0.0500	<0.100	41.2 ⁸	18.1	<25.0	59.3			
Ex1-9-11.0	06/24/02	Central Base	<100	MS	<0.0300	<0.0500	<0.0500	<0.100	<5.00	<10.0	<25.0	ND			
Ex1-10-11.0	06/24/02	Central Base	<100	MS	<0.0300	<0.0500	<0.0500	<0.100	24.1 ⁸	25.1	<25.0	49.2			
Ex1-11-10.0	06/24/02	Southwest Base	<100	MS	<0.0300	<0.0500	<0.0500	<0.100	8.33 ⁸	12.7	<25.0	21.03			
Ex1-12-9.0	06/24/02	Northeast Wall	<100	HS	<0.0300	<0.0500	<0.0500	<0.100	6.97 ⁸	18.7	<25.0	25.67			
Ex1-13-6.0 ⁶	06/25/02	Northeast Wall	<100	HS	<0.0300	<0.0500	<0.0500	1.51	647 ⁸	8,740	<1,000	9,387			
Ex1-14-6.0 ⁶	06/25/02	North Wall	<100	MS	0.864	1.99	<1.00	10.7	1,680	264	33.1	1,977.1			
Ex1-15-7.0	06/25/02	North Wall	<100	MS	<0.0300	<0.0500	<0.0500	<0.100	<5.00	13.9	<25.0	13.9			
Ex1-16-10.0 ⁶	06/25/02	North Base	<100	MS	<0.0300	<0.0500	<0.0500	<0.100	<5.00	15,900	2,550	18,450			
Ex1-17-10.0	06/25/02	North Base	<100	MS	<0.0300	<0.0500	<0.0500	<0.100	<5.00	<10.0	<25.0	ND			
Ex1-18-7.0 ⁶	06/25/02	Northeast Wall	<100	MS	<0.600	5.09	<0.100	21.3	2,760 ⁹	14,200	<2,500	16,960			
Ex1-19-7.0 ⁶	06/25/02	Northeast Wall	<100	HS	0.414	3.80	0.624 ¹⁰	14.7	2,230 ⁹	17,200	<2,500	19,430			
Ex1-20-11.0	06/25/02	North Base	<100	MS	<0.0300	<0.0500	<0.0500	0.222	23.5 ⁸	329	150	502.5			
Ex1-21-10.0	06/25/02	Northwest Base	<100	MS	<0.0300	<0.0500	<0.0500	0.104	7.83	69.5	35.5	112.83			
Ex1-22-9.0 ⁶	06/25/02	West Wall	<100	MS	6.76	58.7	<2.50	246	5,610 ⁹	14,700	4,520	24,830			
Ex1-23-10.0 ⁶	06/26/02	Southwest Base	<100	MS	19.7	70.3	8.63	227	5,200	9,550	5,170	19,920			
Ex1-24-10.0	06/26/02	Northeast Base	<100	MS	0.0805	<0.0500	<0.0500	<0.100	33.4	19.9	<25.0	53.3			
Ex1-25-10.0 ⁶	06/26/02	Central Base	<100	MS	0.180	<0.0500	<0.0500	<0.100	44.8 ⁹	179	<25.0	224			
Cleanup Action Level					0.15	280	1,400	800		NA		6,500			

Notes appear on page 4 of 4.

TABLE 1 (Page 2 of 4)

Soil Sample Number - Depth Sampled ¹ (feet bgs)	Date Sampled	Sample Location	Field Screening Results ²		BETX ³ (mg/kg)				Gasoline-range Hydrocarbons ⁴ (mg/kg)	Diesel-range Hydrocarbons ⁵ (mg/kg)	Heavy Oil-range Hydrocarbons ⁵ (mg/kg)	Sum of TPH (mg/kg)
			Headspace Vapors (ppm)	Sheen	B	E	T	X				
Ex1-26-10.0	06/26/02	Central Base	<100	MS	0.0725	<0.0500	<0.0500	<0.100	28.7 ⁹	415	<25.0	444
Ex1-27-10.0	06/26/02	Southwest Base	<100	MS	<0.0300	<0.0500	<0.0500	<0.100	9.49	18.8	<25.0	28.3
Ex1-28-7.0 ⁶	06/26/02	Northwest Wall	<100	HS	3.30	1.20 ¹⁰	<0.100	6.76 ¹⁰	1,830 ⁸	3,960	2,900	8,690
Ex1-29-7.0	06/26/02	Southwest Wall	<100	HS	0.193	0.478	<0.200	4.05	567 ⁸	493	36.6	1,097
Ex1-30-7.0	06/26/02	Southwest Wall	<100	HS	0.182	0.983	<0.200	3.35	434 ⁸	5,330	543	6,307
Ex1-31-4.0 ⁷	06/26/02	Northeast Wall- replaces Ex1-1-1.0	<100	NS								
Ex1-32-7.0	06/28/02	Southeast Wall replaces Ex1-2-6.0	<100	MS	0.165	<0.250	<0.250	<0.500	288 ⁸	747	31.6	1,067
Ex1-33-7.0 ⁶	06/28/02	Southeast Wall replaces Ex1-3-7.0	<100	MS	28.5	205	13.0	1,020	17,000 ⁸	10,400	<2,500	27,400
Ex1-34-7.0 ⁶	06/28/02	Southwest Wall replaces Ex1-28-7.0	<100	MS	<0.0300	0.548 ¹⁰	<0.500	2.28	1,070 ⁸	4,710	6,710	12,490
Ex1-35-9.0	06/28/02	Northwest Wall replaces Ex1-22-9.0	<100	MS	0.0601	0.260	<0.0500	0.986	92.6 ⁸	549	923	1,565
Ex1-36-12.0	06/28/02	Southwest Base replaces Ex1-23-10.0	<100	MS	<0.0300	<0.0500	<0.0500	<0.100	5.05 ⁸	47.4	52.0	104
Ex1-37-6.0 ⁸	07/01/02	Northeast Wall replaces Ex1-13-6.0	<100	MS	<0.300	<0.500	<0.500	1.34 ¹⁰	548 ⁸	9,720	<2,500	10,268
Ex1-38-7.0	07/01/02	Northeast Wall replaces Ex1-19-7.0	<100	MS	<0.0300	<0.0500	<0.0500	<0.100	<5.00	36.8 ⁹	<25.0	36.8
Ex1-39-7.0	07/01/02	replaces Ex1-18-7.0 North Wall replaces Ex1-14-6.0	<100	MS	<0.274	<0.456	<0.456	<0.912	<45.6	343	254	597
Ex1-40-6.0	07/01/02	Central Base replaces Ex1-25-10.0	<100	MS	<0.0300	<0.0500	<0.0500	<0.100	<5.00	<10.0	<25.0	ND
Ex1-41-12.0	07/01/02	North Base replaces Ex1-16-10.0	<100	MS	<0.0300	<0.0500	<0.0500	<0.100	<5.00	<10.0	<25.0	ND
Ex1-42-12.0	07/02/02	Southwest Wall replaces Ex1-33-7.0	<100	SS	<0.0300	<0.0500	<0.0500	<0.100	<5.00	<10.0	<25.0	ND
Ex1-43-6.0	07/02/02	Southeast Wall	<100	MS	<0.0300	<0.0500	<0.0500	<0.100	<5.00	52.9 ⁹	32.6	84.7
Ex1-44-7.0	07/02/02	Southeast Wall	<100	SS	<0.0300	<0.0500	<0.0500	<0.100	<5.00	<10.0	<25.0	ND
Ex1-45-6.0	07/02/02	Southeast Wall	<100	MS	<0.0300	<0.0500	<0.0500	<0.100	<5.00	<10.0	<25.0	ND
Ex1-46-10.0	07/02/02	Southwest Wall replaces Ex1-34-7.0	<100	NS	<0.0300	<0.0500	<0.0500	<0.100	<5.00	65.4 ¹¹	502	567
Ex1-47-7.0	07/03/02				0.15	280	1,400	800	<5.00	NA		6,500

Notes appear on page 4 of 4.

TABLE 1 (Page 3 of 4)

Soil Sample Number - Depth Sampled ¹ (feet bgs)	Date Sampled	Sample Location	Field Screening Results ²		BETX ³ (mg/kg)				Gasoline-range Hydrocarbons ⁴ (mg/kg)	Diesel-range Hydrocarbons ⁵ (mg/kg)	Heavy Oil-range Hydrocarbons ⁵ (mg/kg)	Sum of TPH (mg/kg)
			Headspace Vapors (ppm)	Sheen	B	E	T	X				
Ex1-48-7.0	07/03/02	Southwest Wall	<100	NS	<0.0300	<0.0500	<0.0500	<0.100	<5.00	12.1 ¹¹	37.3	49.4
Ex1-49-7.0	07/03/02	Southwest Wall	<100	NS	<0.0300	<0.0500	<0.0500	<0.100	<5.00	10.2	<25.0	10.2
Ex1-50-7.0	07/03/02	Southwest Wall	<100	NS	<0.0300	<0.0500	<0.0500	<0.100	<5.00	50.8 ⁹	<25.0	50.6
Ex1-51-7.0	07/03/02	Southwest Wall	<100	NS	<0.0300	<0.0500	<0.0500	<0.100	<5.00	27.4 ⁹	<25.0	27.4
Ex1-52-10.0	07/03/02	Southwest Base	<100	SS	<0.0300	<0.0500	<0.0500	<0.100	<5.00	<10.0	<25.0	ND
Ex1-53-10.0	07/03/02	Southwest Base	<100	SS	<0.0300	<0.0500	<0.0500	<0.100	14.7 ⁸	28.5	47.4	90.6
Ex1-54-7.0	07/03/02	replaces Ex1-37-6.0	<100	SS	<0.0300	<0.0500	<0.0500	0.148 ¹⁰	110 ⁸	3,100	52.1 ¹²	3,262
Excavation 2 - Central Portion of the Site												
Ex2-1-9.0	06/26/02	East Base	100	HS	<0.300	0.166	<0.500	0.713	63.4 ⁸	179	<25.0	242
Ex2-2-9.0	06/26/02	South Base	<100	HS	<0.0300	<0.0500	<0.0500	<0.100	<5.00	15.2	<25.0	15.2
Ex2-3-5.0 ⁶	06/26/02	Northeast Wall	200	HS	0.850	5.38 ¹⁰	<1.00	7.48 ¹⁰	1,800 ⁹	3,360	<250	5,160
Ex2-4-6.0	06/26/02	Southeast Wall	150	HS	<0.300	2.23 ¹⁰	<0.500	4.72 ¹⁰	825	2,420	<250	3,245
Ex2-5-7.0	06/26/02	Southeast Wall	175	MS	0.0970	2.13 ¹⁰	0.0827 ¹⁰	3.54 ¹⁰	1,180 ⁹	2,020	<250	3,200
Ex2-6-5.0	06/26/02	Southwest Wall	200	HS	<0.600	2.63 ¹⁰	<1.00	4.28 ¹⁰	1,010 ⁹	2,380	<250	3,349
Ex2-7-6.0	06/28/02	Southwest Wall	<100	HS	<0.0300	<0.500	<0.500	<1.00	269 ⁸	1,280	<125	1,577
Ex2-8-6.0	06/28/02	Northwest Wall	<100	HS	<0.120	<0.200	<0.200	0.418 ¹⁰	254 ⁸	2,190	<250	2,444
Ex2-9-6.0	06/28/02	Northwest Wall	<100	HS	<0.600	5.66	<1.00	8.26	1,400	1,600	<250	3,000
Ex2-10-6.0	06/28/02	Northeast Wall	<100	HS	<0.0300	<0.0500	<0.0500	0.107 ¹⁰	27.6 ⁸	204	<25.0	232
Ex2-11-9.0	06/28/02	North Base	<100	MS	<0.300	1.92	<0.500	6.88	446	244	<25.0	690
Ex2-12-10.0	06/28/02	North Base	<100	MS	<0.0600	0.447	<0.100	1.58	127 ⁹	165	<25.0	292
Ex2-13-9.0	06/28/02	Center Base	<100	MS	0.0712 ¹⁰	0.952	0.079 ¹⁰	3.3	191	204	25.2	420
Ex2-14-9.0	06/28/02	Center Base	<100	MS	<0.120	0.811	<0.200	2.79	223 ⁹	273	<50.0	496
Ex2-15-5.0	07/01/02	replaces Ex2-3-5.0	<100	MS	<0.0300	<0.0500	<0.0500	<0.100	<5.00	179 ⁹	50.2	229
Excavation 3 - Other												
SS-1 ⁸	07/01/02	Surface Sample	<100	SS	0.0388	0.0798	0.204	0.470	12.9 ⁹	138 ⁹	57.0	208
SS-2-1.0	07/03/02	Northwest Wall	<100	SS	Tested for PAHs, see Table 2							
SS-3-1.0	07/03/02	Southeast Wall	<100	SS	Tested for PAHs, see Table 2							
SS-4-2.0	07/03/02	Base	<100	SS	Tested for PAHs, see Table 2							
Cleanup Action Level					0.15	280	1400	800	6,500			

Notes appear on page 4 of 4.

TABLE 1 (Page 4 of 4)

<p>Notes:</p> <p>¹Approximate sample locations are shown in Figure 3. The final number in the sample identification indicates the sample depth in feet below ground surface.</p> <p>²Field screening methods are described in Appendix C. NS = No sheen; SS = slight sheen; MS = moderate sheen; HS = heavy sheen. Headspace vapors measured with a Bacharach TLV Sniffer calibrated to hexane.</p> <p>³B = benzene; E = ethylbenzene; T = toluene; X = xylenes. BETX analyzed by EPA Method 8021B.</p> <p>⁴Analyzed by Ecology Method NWTPH-Gx.</p> <p>⁵Analyzed by Ecology Method NWTPH-Dx.</p> <p>⁶Soil was subsequently overexcavated.</p> <p>⁷Total metals analyzed by EPA Method 6000/77000 Series Method. Ex1-1-1.0 (overexcavated) contained Arsenic = 61.2 mg/kg, Cadmium = 3.67 mg/kg, Copper = 125 mg/kg, Lead = 558 mg/kg and Zinc = 1,040 mg/kg. Ex1-31-4.0 contained Arsenic = 0.0905 mg/kg and Barium = 0.378. Action levels for metals are as follows: Arsenic = 1 mg/kg, Cadmium = 20 mg/kg, Copper = 2,960 mg/kg, Lead = 250 mg/kg and Zinc = 24,000 mg/kg.</p> <p>⁸Sample chromatogram indicates overlap primarily of diesel.</p> <p>⁹Chromatographic pattern does not resemble the fuel standard used for quantification.</p> <p>¹⁰Concentration may be artificially elevated due to coeluting compounds or components.</p> <p>¹¹Concentration primarily due to overlap of heavy oil.</p> <p>¹²Concentration primarily due to overlap of diesel.</p> <p>ND = not detected</p> <p>bgs = below ground surface; mg/kg = milligrams per kilogram; "—" = not tested; ppm = parts per million</p> <p>Shaded concentration indicates a value greater than the cleanup action level.</p> <p>Chemical analysis conducted by North Creek Analytical of Bothell, Washington. The laboratory reports are presented in Appendix E.</p>	
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TABLE 3
SUMMARY OF SOIL FIELD SCREENING AND BETX AND
PETROLEUM HYDROCARBONS CHEMICAL ANALYTICAL RESULTS
STOCKPILE SAMPLES
THOMAS OIL SITE/NW MARITIME CENTER
PORT TOWNSEND, WASHINGTON

Soil Sample Number	Date Sampled	Field Screening Results ¹		BETX ² (mg/kg)				Gasoline-range Hydrocarbons ³ (mg/kg)	Diesel-range Hydrocarbons ⁴ (mg/kg)	Heavy Oil-range Hydrocarbons ⁴ (mg/kg)	Sum of TPH (mg/kg)	
		Headspace Vapors (ppm)	Sheen	B	E	T	X					
Excavation 1--Unocal Tank Farm												
SP1-1	06/25/02	<100	NS	<0.0300	<0.0500	<0.0500	0.101	<5.00	488	340	828	
SP1-2	06/25/02	<100	NS	<0.0300	<0.0500	<0.0500	<0.100	<5.00	830	820	1,650	
SP1-3	06/25/02	<100	NS	<0.0300	<0.0500	<0.0500	<0.100	<5.00	534	391	925	
SP1-4	06/25/02	<100	NS	<0.0300	<0.0500	<0.0500	<0.100	<5.00	756	978	1,734	
SP1-5	06/25/02	<100	NS	<0.0300	<0.0500	<0.0500	<0.100	<5.00	524	303	827	
Excavation 2--Central Portion of the Site												
SP2-1	07/01/02	<100	NS	<0.0300	<0.0500	<0.0500	<0.100	<5.00	105	46.8	152	
SP2-2	07/01/02	<100	NS	<0.0300	<0.0500	<0.0500	<0.100	<5.00	107	42.4	149	
SP2-3	07/01/02	<100	NS	<0.0300	<0.0500	<0.0500	<0.100	<5.00	85.8	37.4	123	
ISP1-1	07/01/02	<100	NS	<0.0300	<0.0500	<0.0500	<0.100	13.8	138	41.0	193	
ISP1-2	07/01/02	<100	NS	<0.0300	<0.0500	<0.0500	<0.100	33.1	853	107	993	
ISP1-3	07/01/02	<100	NS	<0.0300	<0.0500	<0.0500	<0.100	22.4	540	57.1	620	
Cleanup Action Level				0.15	280	1,400	800	NA				6,500

Notes:

¹Field screening methods are described in Appendix C. NS = no sheen; SS = slight sheen; MS = moderate sheen; HS = heavy sheen. Headspace vapors measured with a Bacharach TLV Sniffer calibrated to hexane.

²B=benzene, E=ethylbenzene, T=toluene, X=xylene. BETX analyzed by EPA Method 8021B.

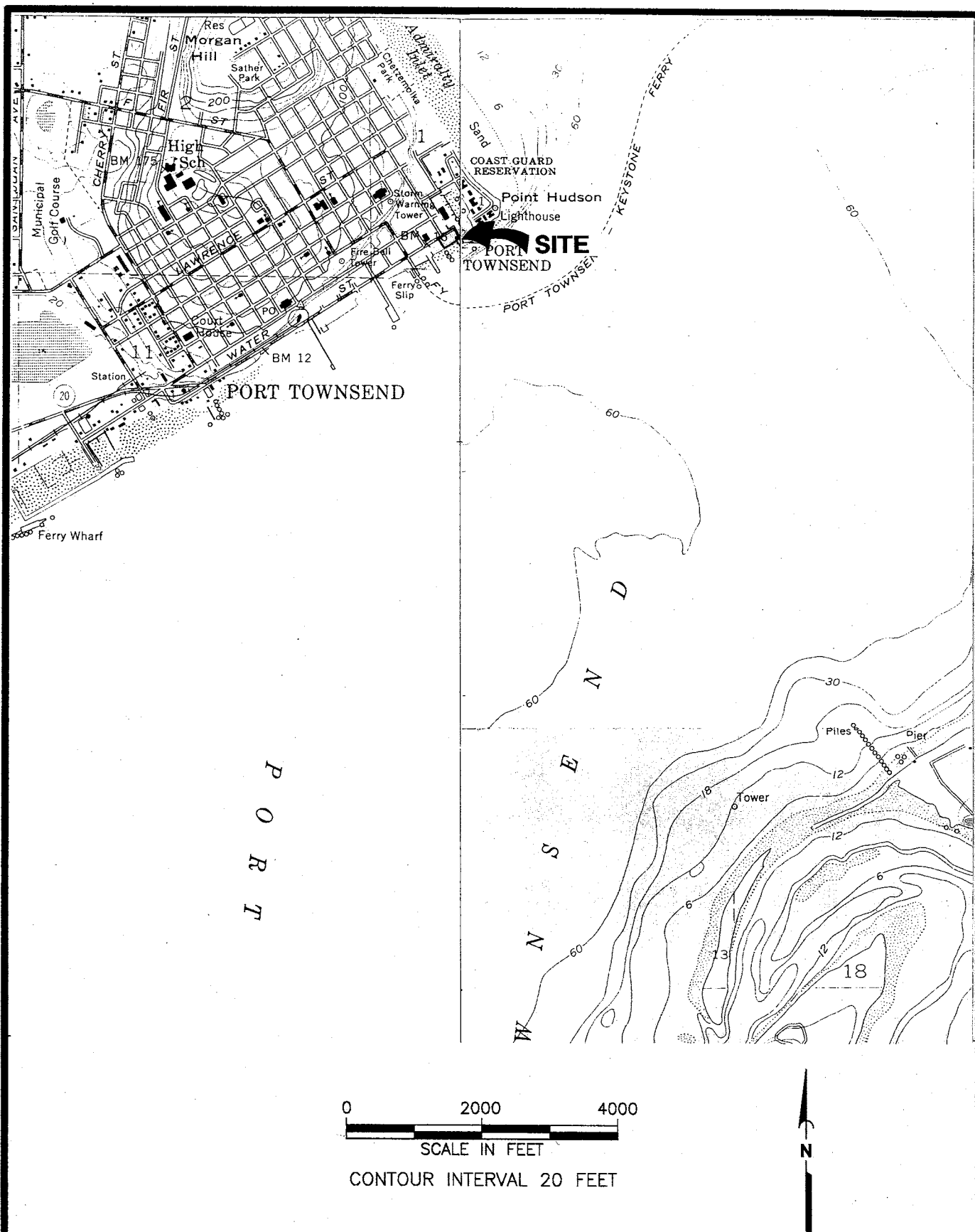
³Analyzed by Ecology Method NWTPH-Gx.

⁴Analyzed by Ecology Method NWTPH-Dx.

mg/kg = milligrams per kilogram; ppm = parts per million

NA = not applicable

Chemical analysis conducted by North Creek Analytical of Bothell, Washington. The laboratory reports are presented in Appendix E.



Reference: USGS 7.5' topographic quadrangle maps "Port Townsend, and Nordland, Wash." 1973.

Geo  Engineers

VICINITY MAP

FIGURE 1